Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
The Emergency Alert System	)	EB Docket No. 04-296
	)	
Frank W. Bell	)	

Re: NOTICE OF PROPOSED RULEMAKING

Towards A Value Based Paradigm For EAS+ And a Comparison of Alerting Technologies.

Frank W. Bell

This submission has three sections. The equations and discussion of the Value Based Paradigm (VBP) is revised from a previous submission. The Comparison of Alerting Technologies (CAT) is based on the VBP and a number of technologies are considered. For simplicity, not all are considered. The spreadsheet to calculate the graphical plot is not included, as the data is often preliminary at this stage. Then in conclusion some points are made which relate to the relevance of Project Management methodologies and making a good definition for a market research project, to obtain much better data for the parameters that are not so accurately known.

VBP

The current societal paradigm under which EAS is currently operating can be described as that of a directed or command economy. This has a benefit that things can get implemented which is better than no paradigm and no progress. However, this is a paradigm that was widely employed in communism, and is not necessarily the best possible. When the fear of fines is the primary motivating factor, this can inhibit progress towards a more mature approach. This paper is not intended to be the definitive statement, but is rather to initiate a discussion on this subject.

The severity of disaster or emergency incidents varies with their average frequency. Less severe incidents may be no less traumatic to the individuals involved, but are more localized, affecting a smaller area or fewer people. The range can be from extinction or civilization changing events such as a major

meteorite impact or Yellowstone caldera eruption to incidents affecting perhaps 5 people such as a traffic accident. While the latter are part of the scale, the management of them usually does not become an emergency management activity. The relationship between the two can be approximated to an equation of the form;

Eq#1 $$\frac{S}{Pm} = \frac{k}{f}$$

where S is severity. An initial assessment for this S is the sum of Deaths (D) + InjuriesDoctorTreated/10 (In) + RelocationsHomesDamaged/100 (Rn) + Work or personal days lost/1000 (Wn) where the n means it is a normalized value. This may be written as
S=D+In+Rn+Wn
Pm is the population in millions, k is a severity constant, and f is the average frequency in days. This curve would probably be better represented graphically with both scales logarithmic. Different types of disasters can be represented in such a graph as different regions. For comparison, the graph for the U.S. can be compared with the results for other nations. Seas and the Antarctic can be another region. Consideration of space is not currently applicable as it is a known hazardous environment. I have not been able to obtain data to chart such a graph and to fit a value of k at present, assuming that this is a first approximation.

An example of a curve of this type is the relationship between electrical power disturbances and their average frequency of occurrence, although the CBEMA curve handles low and high variations separately. FEMA has published a graph resembling the equation.

The value of an emergency message can be considered to be in proportion to the number of people that it is relevant to but less the annoyance or time wasted of people who receive the message but to whom it is not relevant. An equation approximating this is in the form;

Eq#2 $$v = Ir - A(p - r)$$

where v is value, I is the importance value of that message event code, r is the number of relevant recipients, A is the annoyance value or that message event code, and p is the population of recipients.

This gives, for example in one year, a total value of;

Eq#3

$$V = \sum_{n=1}^{n=N} \{I(E)r(n) - A(E,C)\{p(n,C) - r(n)\}\}$$

where V is the Value per year, n is the particular incident, N is the total number of incidents, r(n) and p(n) are the values of r and p for each incident. E is the event code. C is the consumer choice as to whether they select a basic receiver that receives all EAS+ messages, or they have the added feature of selectivity by location and priority. I is a function of the event code. A is also a function of the event code and the consumer choice. p is a function of the recipients of the message coverage area and C the consumer selectivity.

The values of I (1 column) and A (more than one column) would be a table with units of hours preferably, or of $ U.S. (year) for each event code. In order to ascertain values of this, then an evaluation would be needed. Sources for this information would include but not be restricted to the Department of Homeland Security, the International Association of Emergency Managers, the Insurance Information Institute, the Society of Broadcast Engineers, the State Emergency Communications Committees, a well-researched public opinion poll, relevant engineering standards committee(s), the United Nations International Strategy for Disaster Reduction (and related organizations) and the opinion of experts such as Art Botterel. The values for I should be reasonably straightforward to determine, but the values for A may be more difficult to ascertain. This table should be applicable to messages delivered by other means such as reverse 911, texting, PA systems, email, etc. Such research should also assess what should be an appropriate public education campaign. Also the RMT text can be changed to note that EAS+ compatible or compliant receivers would not have messages interrupting program audio unless all messages are selected.

So, to increase the value of EAS or any other alerting technology, there are some approaches to take, which are complementary.

A) reduce (p-r) by making the message delivery as selective as possible to those relevant to the message, preferably without excluding any r (recipients). The technology to accomplish this is discussed in related material. There would be two values of p, the total area recipients and the selected area recipients.
B) Increase N, the number of incidents for which EAS is used. However because of Eq#1, this means that there are only really severe incidents available for which this can be applied to. While AMBER Alert is a message type that only directly affects a few people, it is one where the A (annoyance constant) is very low. As TV stations cover a large area, perhaps several states, then EAS messages from all these states can be included. The value of A is in part determined by the recipient, as the

proposals have outlined that all basic radios and TVs will receive EAS messages, but EAS+ compatible or compliant receivers will have the selectivity feature at some added price. Also, the capability of the user to exclude lower priority messages in EAS+ compatible receivers will reduce A.

C) Add relevant types of incidents. These can be water supply emergencies and school weather closings for example. As there are already means to address these issues, this can be a decision of the local jurisdiction as to which message types become added to the responsibilities of the Emergency Management Office. Radio stations may prefer to retain the school weather closing messages as a means of retaining audience. However as most household radios are basic analog, this can receive the EAS messages, but increasingly car radios are HD radios, and this opens the possibility for selectivity to be applied so the drive time music is not interrupted unless the audience selects the EAS priority low enough.

The UNISDR approach to emergency alerting is primarily in response to the Asian tsunami. While this has led to some policy development progress, the result may be to develop a system that lacks a value paradigm. This can result in a significant expenditure for a system that may not be used with sufficient frequency as to justify the expense of continued development, staff training and maintenance in an annual budget. The result in twenty years will be that the money is not forthcoming for the replacement to the original equipment. So a value based paradigm is relevant to that effort also, and by using hours as units, the paradigm should be the same. This can be translated to money by multiplying by the average cost of wages and economic disruption.

Another important part of the value is the cost side of the cost/value ratio. Relating to this, most people are not aware that the price of multistandard TVs (which are analog TVs that can be used in any part of the world and hence are more complex) has become lower than SECAM (French and Soviet) only TVs. This is illustrating the benefit of designing a system and relevant products once and selling them worldwide. Even the U.S. is a limited size market, and already all automobile manufacturers have abandoned the use of U.S. standard threads. For this reason, it is more cost effective to not have a U.S. Government specification, but instead to have a standard developed by a relevant engineering standards committee, which can be referenced by other governments. Also such standards committees have the best technical expertise as members, and so are more thorough in the development of a standard. Employees have an inclination to choose the continuation of their career instead of what might be the best solution because of their employers' popular flavor of the month. IT employees made this observation.

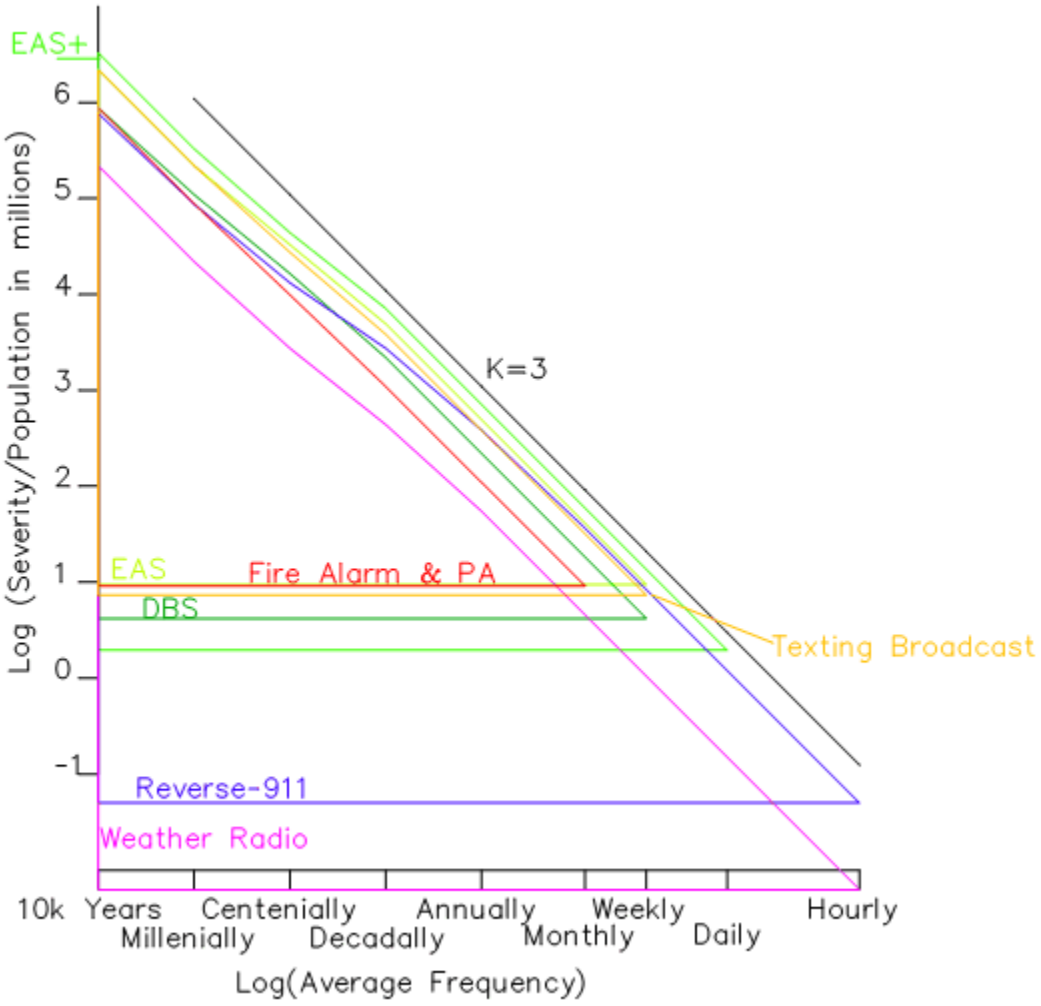
An important aspect of an appropriate paradigm is that it should enable all the participants to buy in to the system. How this translates in financial terms is relevant, but this pertains to discussion between the various parties, and is rather beyond this paper in which I am focusing on the relevant paradigm and economic theory.

A Comparison of Different Alerting Technologies (CAT)

Using a chart of disaster data and presenting it in the form of Equation 1, different technologies can be compared as to their theoretical or effective applicability. A spreadsheet of different alerting technologies follows. Some technologies change rapidly, such as the penetration of cellphones, digital TV and HD radio. Each technology would be applicable to a region on the chart. Having an overlap on this chart is not a problem as there may be locations where one technology is functional and not others, or areas of higher population may be served by multiple technologies, but individuals may be reached by one and not another. Individuals may receive multiple alerts from different technologies, and this may reduce the distribution time or provide redundancy in case of some system failure. Also as there may be some infiltration of a system at some time, the lack of confirming messages from other systems would be taken as an indication of a possible false alarm. Monitoring by Emergency Management QC systems should lead to the issuing of a FAW (False Alarm Warning) and investigation in such cases. CAP Broadcast is a different mode of EAS+ and is treated here as a different technology. Analog radio stations have EAS Endecs, these may be upgradeable to EAS+ compatible mode, which should be acceptable for the remainder of the life of the unit. All alerts would be for immediate override of programming for such Endecs.
All technologies shall be capable of accepting a CAP interface, though there may be some translation required by such an interface. Emergency Management Offices and other government entities may wish to use input including presets, geographic location with on-screen maps, FPIS codes, Post or Zip codes, county sectors or others. Some functionality of CAP may be limited. So interfaces shall provide translation to the driven technology. EAS+ shall provide a good matching of functionality as it is a backup distribution system.

		A Comparison of Public Emergency Alerting Technologies								
Technology	% Penetration	Response Time	Severity Range	Location Selectivity	FUL (Frequent	Note	Audio/Text/Video other	CAP compatible?	Secure	User Selectivity
	Day/Night varies	for priority 1	limitations or notes		Usage Limit)					poss. for severity
Cable/Telco TV	30	8 sec (EAS+) to 8 min (EAS)	Power dependant	Very Good (EAS+) to Moderate (EAS)	Weekly	Depends on STB location setup	ATV	VG to possible	High	Yes
CAP Broadcast	2	30 sec	Power dependant	Very Good	Weekly	Only to computers	ATV & open file transfer	Excellent	Medium	Yes
DBS	20	15 sec	Power dependant, poor for earthquakes	Very Good	Monthly/locality	Depends on STB location setup	ATV	Good possible	Excellent	Yes
DEAS	2	3 min (manual mode)	Power dependant	Depends on polygon format	Daily	Emergency Management core technology	ATV & open file transfer	Excellent	Excellent	TBD
EAS Broadcast	45	8 min	Only for severe incidents	Poor	Monthly	OK for wide area & severe events	AV	Possible	High	No
EAS+ Broadcast	65	6 sec	Severe to smaller incidents	Good to Very Good	Weekly->Daily	Cheaper radio & TV has no selectivity in	ATV	Very Good	Excellent	Yes
FA+PA	10	10 sec	PA is infrastructure power dependant	Very Good	Annually	Limited by source signal selectivity	A and flash, T possible	Good possible	Medium	No
(Fire Alarm announcement & Public Address)							(sirens some locations)			
IHS (Intelligent High	1	3 min (manual mode)	Driver relevant	Very Good	Daily as backup	Good for AMBER ALERT	T (A radio some locations)	Poor	Excellent	No
NOAA Weather	5	5 min	Moderate to severe, and weather	Poor	Daily	Transmitter coverage limited	AT	Very Good	Excellent	Not at present
Pager message	2	5 min	Only for severe incidents	Poor	Monthly	Transmitter coverage limited	T	Poor	High	No
Proprietary	3	3 min	depends	Excellent	Weekly	Number of systems, often email lists	depends	depends	depends	Depends
Reverse-911	40	5 min	Not for earthquakes	Very Good to Excellent	Daily when selective	Depends on location database lookup	A, some text possible in future	Good possible	Medium	See note
SDARS	5	15 sec	Poor for earthquakes	Good to Very Good	Monthly/locality	Depends on navigation input	AT	Good possible	Excellent	Yes
Texting Broadcast	35	8 sec	Infrastructure power dependant	Good to Excellent	Monthly	Depends on location input	T, pictures possible AMBER	Good, pictures possible	High	If provided for
Texting Email	35	30 sec	Infrastructure power dependant	Excellent	Monthly	To individual in email list, may be elsewhere	T, pictures possible AMBER	Good, pictures possible	Medium	Yes
	(Overlap>100%)	(of highest priority)					open file means no macros or			
Proprietary may include 3nonline, Amcom, AtHoc, Cistera, DCCUSA, Firstcall, Instalert, Madah, Messageone, Mir3, Omnilert, Roamsecure, Sendwordnow, Squareloop, Varolii & others							links formats & freely decodable			

Notes;
1) EAS+ can be applied in consumer electronics as turn on with selected message receipt e.g. for nightstand radios. The location and user priority selectivity lend it to that. This aids the penetration by being applicable for sleeping time use. However a requirement for EAS+ compatibility would also include multiple power sources.
2) Cellphones have an increasing penetration. So the number here can change. However they are not particularly loud for awaking people, and as there is the possibility of false calls and that some cellphones do not float the battery overnight after an initial charge, many people are inclined to turn them off at night.
3) POTS and internet phones both can receive many false calls, so many people have answer machines take the calls, particularly when sleeping. This reduces the effective penetration.
4) The Weekly->Daily usage frequency for EAS+ refers to the initial limitation of EAS+ when there only standard radios and TVs installed initially. The increasing frequency would become acceptable as consumer electronics gets replaced with EAS+ compatible devices.
5) There may be data available that I do not have access to currently. This can be used to make the chart more accurate. Where there is no data available, then the market research proposed in the first part of this paper can also be extended to assess answers to these questions.
6) On the technology comparison plot, the effect of improved penetration is to move the line up closer to the K line. At lower frequency events, which are increasingly earthquakes and tsunamis, a longer response time effectively reduces the penetration, and this is indicated by the larger gap at the top left for some technologies. Some technologies lend themselves to more frequent usage. This results in extending the curve to the lower right, with a lower baseline. This is usually through increased selectivity and acceptable use of less severe event codes. EAS+ is extended in all 3 directions compared with EAS. Weather radio has a lower penetration, but it is a dedicated function and so can be used more frequently, hourly here. By comparison, Reverse-911 can be very selective and so used more frequently.
7) A better fit curve than the approximation of Eq# 1 can be put into the spreadsheets to calculate the curves.


EAS+
6
5
4
3
2
1
0
-1
Log (Severity/Population in millions)
K=3
EAS
Fire Alarm & PA
DBS
Texting Broadcast
Reverse-911
Weather Radio
10k Years
Millenially
Centenially
Decadally
Annually
Monthly
Weekly
Daily
Hourly
Log(Average Frequency)

CONCLUSION;
The methodology here can compare the situations for different types of emergencies and disasters, and a more accurate paradigm for the reality can be considered. Then comparing the performance characteristics of differing alerting technologies, both actual and theoretical, the comparison can be made between them and the best case which would be 100% penetration, selectivity applicable for the whole range of emergencies and disasters, and a response time of less than a second so as to be able to address the most rapid onset emergencies and disasters. Such a technology is not currently feasible, but an approach of multiple overlapping systems can provide a much better coverage of all aspects and also provide some redundancy in the majority of situations. Redundancy is important as these systems can also fail in such situations.

The Project Management of this is not a simple exercise. As pointed out some time ago, there are multiple standards that require development for example. Also the Price-Quality-Time triangle has validity, but as new technology is being developed, the management methodology also needs improvement. An excellent discourse on this is in "Reinventing Project Management" Aaron J. Shenhar & Dov Dvir *Harvard Business School Press.* ISBN 978-1-59139-800-4. There are reviews on Amazon.com. For those not familiar with project management, a comprehensive source is www.pmi.org. An analysis of the project management plan including what is appropriate in terms of the four dimensions of Technology, Pace, Novelty and Complexity is appropriate.

The subjects in this paper indicate a basis for a well defined market research exercise, to define;

a) A better definition of Eq#1.
b) Values for I and A for each EAS code, including added codes that could be applied with increased selectivity and other considerations e.g. false alarms, redundant alerting of first responders, water supply warnings, school weather closings, etc.
c) Possible other extensions that can be considered even if not immediately implemented.
d) The improved penetration possible by making the system more selective in various ways including providing some user adjustability to provide for their situations e.g. night shift workers, low income, handicapped, etc.
e) What legal sanctions are considered reasonable by the various stakeholders.